

REMARKS

In the Office Action, the Examiner rejected claims 1-8, 10-12, 14-27, 29-34 and 36-47 under 103, and claims 10-12, 29 and 43-47 under 112. These rejections are fully traversed below.

Claims 10-12, 29, 30, 43, and 46 have been amended. Claims 48-50 have been added. Thus, claims 1-8, 10-12, 14-27, 29-34, and 36-50 are pending in the application. Reconsideration of the application is respectfully requested based on the following remarks.

Response to Arguments

While alignment and overlay may appear to be related, it should be emphasized that alignment is solving a fundamentally different problem and therefore it uses fundamentally different targets and techniques. Because of this, one skilled in the art would simply not be motivated to combine the teachings of the two to come up with the claimed invention. That is, one skilled in the art would not have been expected to look at alignment patents to obtain guidance as to how to improve overlay since they are fundamentally different.

On a high level, alignment deals with aligning an exposure system, and more particularly a mask of the exposure system to a wafer while overlay deals with the positional accuracy between two feature sets coexisting on a single substrate. That is, alignment is performed between a mask and a wafer, NOT between two existing layers on a wafer. As required by claim 1, "...the first set being disposed on a first layer of the substrate...the second set being disposed on a second layer of the substrate..."

On a much lower level, in alignment, the mask includes an alignment key and the wafer includes an alignment target. These objects are substantially separated in space along the optical axis of the exposure tool and are always superimposed on the one another when aligning the mask to the wafer. In overlay, the two feature sets (formed during different patterning steps on the wafer), are not separated in space along the optical axis but rather laterally spatially separated and distinct in the object space. There is no superposition of the objects. As stated in *Kaiser*, "alignment marks to be superimposed for aligning an optically transparent first object and a

second object relative to each other (claim 1).” Furthermore, as stated in *Dirksen*, “...the dimension of the mask mark M2 is adapted to that of substrate mark P2 so that the image of the mark P2 accurately coincides with the mark M2 when the two marks are mutually positioned correctly (Col. 12, lines 38-41).” Accordingly, the use of *Kaiser* and *Dirksen* is improper and the rejections should be withdrawn.

It should be further pointed out that neither of these references (*Kaiser* and *Dirksen*) provide any motivation for applying their teachings to overlay. These references are completely silent to overlay. The fact that they may appear to be related to overlay is not enough. They are from different fields, and are solving very different problems. Simply put, the claimed invention taken as a whole cannot be said to be obvious without some reason given in the prior art why one of ordinary skill in the art would have been prompted to combine the teachings of the references to arrive at the claimed invention. MPEP 2143.01 provides: The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. In re Mills, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Furthermore, the Federal Circuit has repeatedly warned against using the applicant’s disclosure as a blue print to reconstruct the claimed invention out of isolated teachings in the prior art. See for example *Grain Processing Corp. v. American Maize-Products*, 840 F. 2d 902, 907, 5 USPQ2d 1788, 1792 (Fed. Cir. 1988).

In addition, while *Dirksen* may show what appears to be fine segmentation, *Dirksen* is solving a fundamentally different problem and makes no mention of improved accuracy of measurement or improved device correlation by segmentation. *Dirksen* proposes using existing alignment technology to characterize focus and dose parameters. *Dirksen* teaches that two marks are required – an unsegmented alignment mark for alignment purposes and a “test mark” for test purposes such as characterizing focus, dose or astigmatism. *Dirksen* therefore is silent to an alignment mark that includes fine segmentation. It is only the test mark that includes what appears to be fine segmentation, and the test mark is not used for alignment but rather for characterizing focus, dose or astigmatism. Accordingly, the use of *Dirksen* is improper and the rejections should be withdrawn.

With regards to the Examiners comment about “comparing a portion of the mark to another portion or to another mark to determine alignment of two patterns on the wafer” not being a claimed limitation, the Examiner is directed to claims 12 and 27.

Claim Objections

It is believed that the objection has been overcome by the amendment made above (see Listing of Claims).

Claim Rejections – 35 USC 112

It is believed that the objections have been overcome by the amendments made above (see Listing of Claims).

Claim Rejections – 35 USC 103

Claims 31-34 and 42 have been rejected under 35 U.S.C. 103(a) as being unpatentable over *Bareket* (EP 0818814), and further in view of *Dirksen* et al (5,674,650).

The rejections should be withdrawn for at least the reasons stated above. One skilled in the art would simply not be motivated to combine these references.

Furthermore, even if alignment and overlay can be properly combined, *Dirksen* does not teach or suggest an alignment mark with fine segmentation. In *Dirksen*, it is only the test mark that includes what appears to be fine segmentation, and the test mark is not an alignment mark. The test mark is used to characterize such things as focus, exposure dose and astigmatism. Neither reference solely or in combination teaches or suggests, "...the overlay mark having a plurality of working zones, each of the working zones including a periodic structure of coarsely segmented elements and wherein the coarsely segmented elements are formed by a plurality of finely segmented elements..." as required by independent claim 31 (and its dependents). Accordingly, the rejection is unsupported by the art and should be withdrawn.

Although the rejections to the dependent claims should be withdrawn for at least the reasons, it should be noted that they offer additional language that is unsupported by the art. For example, in contrast to both references, claim 42 specifically requires, "...wherein the finely segmented elements are configured to mimic one or more device features formed on the substrate

with the finely segmented elements..." Accordingly, the rejection is unsupported by the art and should be withdrawn.

Claims 1-8, 10-12, 14-27, 29 and 36-39 have been rejected under 35 U.S.C. 103(a) as being unpatentable over *Kaiser* (5,172,190) in view of *Bareket* (EP) and further in view of *Dirksen*.

A prima facie case of obviousness has not been properly made. *Kaiser* and *Dirksen*, which teach alignment, simply cannot be properly combined with *Bareket*, which teaches overlay. See arguments above. Accordingly, the rejection is improper and should be withdrawn.

In any event, all the references and in particular *Dirksen* fail to teach or suggest, "...each of the periodic structures including a plurality of coarsely segmented elements that are formed from a plurality of finely segmented elements," as required by claim 1 or "...the coarsely segmented elements being oriented in a first direction and formed from a plurality of finely segmented elements...the coarsely segmented elements being oriented in the first direction and formed from a plurality of finely segmented elements," as required by claim 20. While *Dirksen* may disclose what appears to be fine segmentation (and even this is in question), it is not the alignment mark that is finely segmented but rather a test mark. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Although the rejections to the dependent claims should be withdrawn for at least the reasons, it should be noted that they offer additional language that is unsupported by the art. For example:

In contrast to all the references, claims 8 and 24 specifically require, "...wherein the working zones are configured to diminish an impact of non-uniformities across the mark on tool and wafer induced shifts." The Examiner provides no support for her argument outside of Figures 1 and 2, and these Figures do not teach such a feature. The Examiner is encouraged to provide additional evidence as for example from the specification to maintain the rejection. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claims 14 and 29 specifically require, "...wherein the finely segmented elements are configured to provide shift information that more closely

matches the relative shift between patterns of an integrated circuit formed on each of the two layers of the substrate..." The specification of *Dirksen* is silent to such a feature and Fig. 6C, which was used to support the Examiner's argument, simply does not provide ample support for this limitation. The most that can be said about Fig. 6C is that it shows partial asymmetric segmentation. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 25 specifically requires, "...wherein the pitch, period and duty cycle of the coarsely segmented elements is configured to balance the resolution of a metrology used to make the overlay mark and the robustness of the process used to form the layers." Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to all the references, claim 36 specifically requires, "...wherein the finely segmented elements are symmetrically positioned within the coarsely segmented elements of the periodic structures." In *Dirksen*, the lines are only partially segmented over one half of the line to induce an asymmetry in the signal collected from the mark, and more particularly to induce an asymmetric response in the alignment metric as a function of focus dose or optical system parameters such as astigmatism. Fig. 6C which was relied upon by the Examiner only shows one half of the line being segmented. The rest of the Figures suffer from the same problem. See for example Figs. 18B, 18C, 20B, 21B, 21C, and 22. Furthermore, *Dirksen* states, "...By overexposing the resist when the asymmetrical test mark is imaged...(Col. 17, lines 18 and 19)." Accordingly, the rejection is unsupported by the art and should be withdrawn.

Claims 30, 40 and 41 have been rejected under 35 U.S.C. 103(a) as being unpatentable over *Cresswell* (5,617,340), and further in view of *Dirksen et al* (5,674,650).

Claims 43-47 have been rejected under 35 U.S.C. 103(a) as being unpatentable over *Dirksen* in view of *Cresswell*.

The rejections should be withdrawn for at least the reasons stated above. One skilled in the art would simply not be motivated to combine these references. One is directed at overlay and the other is directed at alignment/focus/exposure. Furthermore, *Cresswell* is directed at electrical measurements and not optical measurements as in the present invention. For this reason alone, any rejection using *Cresswell* is improper. Electrical and optical measurements are simply not in the same field of endeavor. Accordingly, the rejections should be withdrawn.

In any event, neither reference teaches or suggests, "...each of the coarsely segmented elements being formed by a plurality of finely segmented elements," as required by claim 30. *Dirksen* simply provides no support for such a limitation (see above). Accordingly, the rejection is unsupported by the art and should be withdrawn.

With regards to claim 43, the Examiner is urged to look at Fig. 9 of the present invention. Like claim 43, the mark is separated into four quadrants, and each of the quadrants includes at least two separately generated working zones that are juxtaposed relative to one another. Moreover, the upper left quadrant includes working zones in a first direction, the upper right quadrant includes working zones in a second direction, the lower right quadrant includes working zones in the first direction, and the lower left quadrant includes working zones in the second direction. No such arrangement is taught in any of the cited references. In *Dirksen*, each quadrant only includes one grating. See Fig. 2. Accordingly, the rejection is unsupported by the art and should be withdrawn.

Although the rejections to the dependent claims should be withdrawn for at least the reasons, it should be noted that they offer additional language that is unsupported by the art. For example, in contrast to both references, claim 40 specifically requires, "...wherein the finely segmented elements are configured to mimic one or more device features formed on the substrate with the finely segmented elements." Accordingly, the rejection is unsupported by the art and should be withdrawn.

Also in contrast to both references, claim 46 specifically requires, "...the finely segmented elements being symmetrically positioned within each of the coarsely segmented lines." Again, *Dirksen* only teaches asymmetric segmentation. Accordingly, the rejection is unsupported by the art and should be withdrawn.

SUMMARY

Applicant believes that all pending claims are allowable and respectfully requests a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,

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